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Novelties from the Northern Mountains Complex of Madagascar IV: A new Rinorea Aubl. (Violaceae) of restricted range from the Galoko and Kalabinono massifs

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Abstract

WAHLERT, G.A. (2016). Novelties from the Northern Mountains Complex of Madagascar IV: A new Rinorea Aubl. (Violaceae) of restricted range from the Galoko and Kalabinono massifs. *Candollea* 71: 205-210. In English, English and French abstracts. DOI: http://dx.doi.org/10.15553/c2016v712a6

Rinorea callmanderi Wahlert *(Violaceae)*, a new species from northwestern Madagascar, is described and illustrated. This new species was discovered during an intensive floristic inventory in the botanically unexplored Kalabinono and Galoko massifs. Based on morphological and molecular evidence, the new species is placed in *Rinorea* subsection *Verticillatae* Engl., the most species-rich group of *Rinorea* Aubl. in Madagascar. *Rinorea callmanderi* is morphologically most similar to *Rinorea mutica* (Tul.) Baill. by its opposite-leaved phyllotaxy and condensed, subsessile cymose inflorescence, but differs by the shape and size of the leaf, the pattern of pubescence on the inner surface of the petal, and the presence of dorsal and ventral anther connective scales. The new species is described and provided with line drawings, a distribution map, a discussion on its morphology, and a preliminary conservation assessment using the IUCN Red List Categories and Criteria.

Résumé

WAHLERT, G.A. (2016). Nouveautés du Complexe des Montagnes du Nord de Madagascar IV: Une nouvelle espèce à distribution restreinte dans le genre Rinorea Aubl. (Violaceae) des massifs montagneux du Galoko et du Kalabinono. *Candollea* 71: 205-210. En anglais, résumés anglais et français. DOI: http://dx.doi.org/10.15553/c2016v712a6

Rinorea callmanderi Wahlert *(Violaceae)*, une nouvelle espèce du nord-ouest de Madagascar, est décrite et illustrée. Cette nouvelle espèce a été découverte lors d'un intense inventaire floristique dans les massifs botaniquement inexplorés du Galoko et du Kalabinono. Sur la base de données morphologique et moléculaire, la nouvelle espèce est placée *Rinorea* subsection *Verticillatae* Engl., groupe le plus riche en espèces du genre *Rinorea* Aubl. à Madagascar. *Rinorea callmanderi* est morphologiquement proche de *Rinorea mutica* (Tul.) Baill. par sa phyllotaxie à feuilles opposées et condensés, et son inflorescence en cyme subsessile, mais en diffère par la forme et la taille de la feuille, le type de pubescence sur la surface interne des pétales et la présence des écailles dorsal et ventral du connectif des anthères. La nouvelle espèce est pourvue de dessins au trait, une carte de distribution, une discussion sur sa morphologie ainsi qu'une évaluation préliminaire du statut de conservation selon les Catégories et les Critères de la Liste Rouge de l'UICN.

Keywords

VIOLACEAE – *Rinorea* – Kalabinono – Galoko – Madagascar – New species – Taxonomy

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Introduction

Rinorea Aubl. is the second most species-rich genus in the *Violaceae*, containing c. 250 species (Ballard et al., 2014). The genus, with a pantropical distribution, is composed of shrubs and small trees that occur in humid and seasonally dry rainforests. In Madagascar – a center of endemism for the genus – *Rinorea* is currently represented by 25 species, of which c. 80% are endemic (Madagascar Catalogue, 2016). The species of *Rinorea* in Madagascar and the Comoro Islands can be placed into six infrageneric groupings, one of which is *R.* subsect. *Verticillatae* Engl. (Wahlert, 2010). The subsection is easily distinguished from other Paleotropical groupings by the opposite arrangement of leaves along the stem. In the treatment of the *Violaceae* for the "Flore de Madagascar et des Comores" series, Perrier de la Bâthie (1954) recognized 17 taxa with opposite leaves, making *R.* subsect. *Verticillatae* the most species-rich group of *Rinorea* in Madagascar. Preliminary taxonomic studies have estimated an additional 5-8 undescribed species from the subsection, which is endemic to Madagascar and the Comoro Islands (Wahlert, 2010). Morphologically, species belonging to the subsection are similar by the shape and structure of the flowers and fruits, but are differentiated primarily by vegetative characters and whether or not the inflorescence is contracted and subsessile or expanded and pedunculate.

Two recent molecular phylogenetic studies based on analyses of nuclear and plastid DNA sequences have focused on the African and Malagasy species of *Rinorea* (Wahlert & Ballard, 2012; van Velzen et al., 2015). Both studies corroborated the monophyly of *R.* subsect. *Verticillatae* and provided evidence that the character state of opposite-leaved phyllotaxy is a diagnostic apomorphy for the subsection, as well as for the unrelated Neotropical *Rinorea pubiflora* group. In the phylogeny of Wahlert et al. (2012), eight species from *R.* subsect. *Verticillatae* were sampled – including the new species described here – and were recovered in a highly supported Verticillatae clade. The clade was resolved in a sister relationship to a clade containing all Asian species sampled in the study, a result which could suggest a biogeographic origin of *R.* subsect. *Verticillatae* in Madagascar by long-distance dispersal of an Asian ancestor.

Floristically, Madagascar is one of the world's great diversity hotspots, and until recently, the Galoko and Kalabinono (previously known as Kalabenono) massifs in northwestern Madagascar were mostly unexplored by botanists (Phillipson et al., 2006; Callmander et al., 2009, 2012). These massifs, situated in the southern portion of a mountain range, are composed of the Isalo Sandstone formation (Besairie, 1936) with the two prominent high points named Galoko (1153 m) and Kalabinono (1148 m) (Gachet, 1958). Over the period from 2005 to 2008, an intensive plant inventory effort by botanists from several institutions was made in the Northern Mountains Complex, including Galoko-Kalabinono, resulting in the description of several species new to science (Callmander et al., 2012, and citations therein). With an increased awareness of the unique diversity of these mountains, the conservation community in Madagascar launched a plan to protect them through the Managed Resources Protected Areas (MRPA) project. The new Ampasindava-Galoko-Kalabinono Protected Area was announced in 2010, and is currently managed by the Missouri Botanical Garden in Antananarivo (MEF, 2014).

In 2008, a collection of *Rinorea* from the Kalabinono massif was communicated to the author by M.W. Callmander. The morphologically distinctive specimen did not conform to any descriptions given by Perrier de la Bâthie (1954) and was later determined to be a new species belonging to *R.* subsect. *Verticillatae*. In 2013, another specimen of the same undescribed species was collected from the nearby Galoko massif. Taken together, the two specimens comprise sufficient material to allow for a circumscription of a new species, which is described below. In addition, line drawings and a distribution map are provided, as well as a preliminary conservation assessment based on the IUCN Red List criteria (IUCN, 2012). This article is the fourth contribution in a series devoted to novelties from the Northern Mountains Complex (Callmander et al., 2008, 2009, 2012).

Taxonomic treatment

Rinorea callmanderi Wahlert, **spec. nova** (Fig. 1).

Typus : Madagascar. Prov. Antsiranana : Ambilobe, Beramanja, Anketrabe, forêt de Kalabenono, 13°38'50"S 48°40'34"E, 778 m, 23.XI.2006, fl., *Callmander et al. 582* (holo-: G [G00341675]!; iso-: K!, MO!, P [P00853251]!, TAN).

Rinorea callmanderi Wahlert is similar to R. mutica (Tul.) Baill. by its opposite-leaved phyllotaxy and contracted, subsessile, few-flowered cymose inflorescence, but differs by its oblanceolate leaves to 13 cm long (vs. broadly oval-elliptic leaves to 9 cm long in R. mutica), the inner surface of the petals sparsely pubescent near the middle (vs. the inner surface with a tuft of hairs near the apex), the presence of a linear, ventral scale on the anther connective (vs. ventral scale absent), and the presence of an ovate dorsal scale on the anther connective (vs. dorsal scale absent).

Shrub to 3 m tall; young branches flattened in cross section, glabrous to puberulent; stipules not seen. *Leaves* opposite, equal to anisophyllous; petiole 1.5-5 mm long, glabrous; blade 4-13 × 1.2-5 cm, oblanceolate, glabrous on both surfaces; base attenuate-cuneate, symmetrical, aequilateral to suboblique; secondary vein pairs 6-9, divergent to ascending, tertiary veins reticulate; margin serrulate, often revolute; apex acuminate;

Fig. 1. – *Rinorea callmanderi* Wahlert. **A.** Inflorescence; **B.** Flowering branch; **C.** Flower; **D.** Leaf, abaxial surface. [*Callmander* 582, G] [Drawing: R. L. Andriamiarisoa]

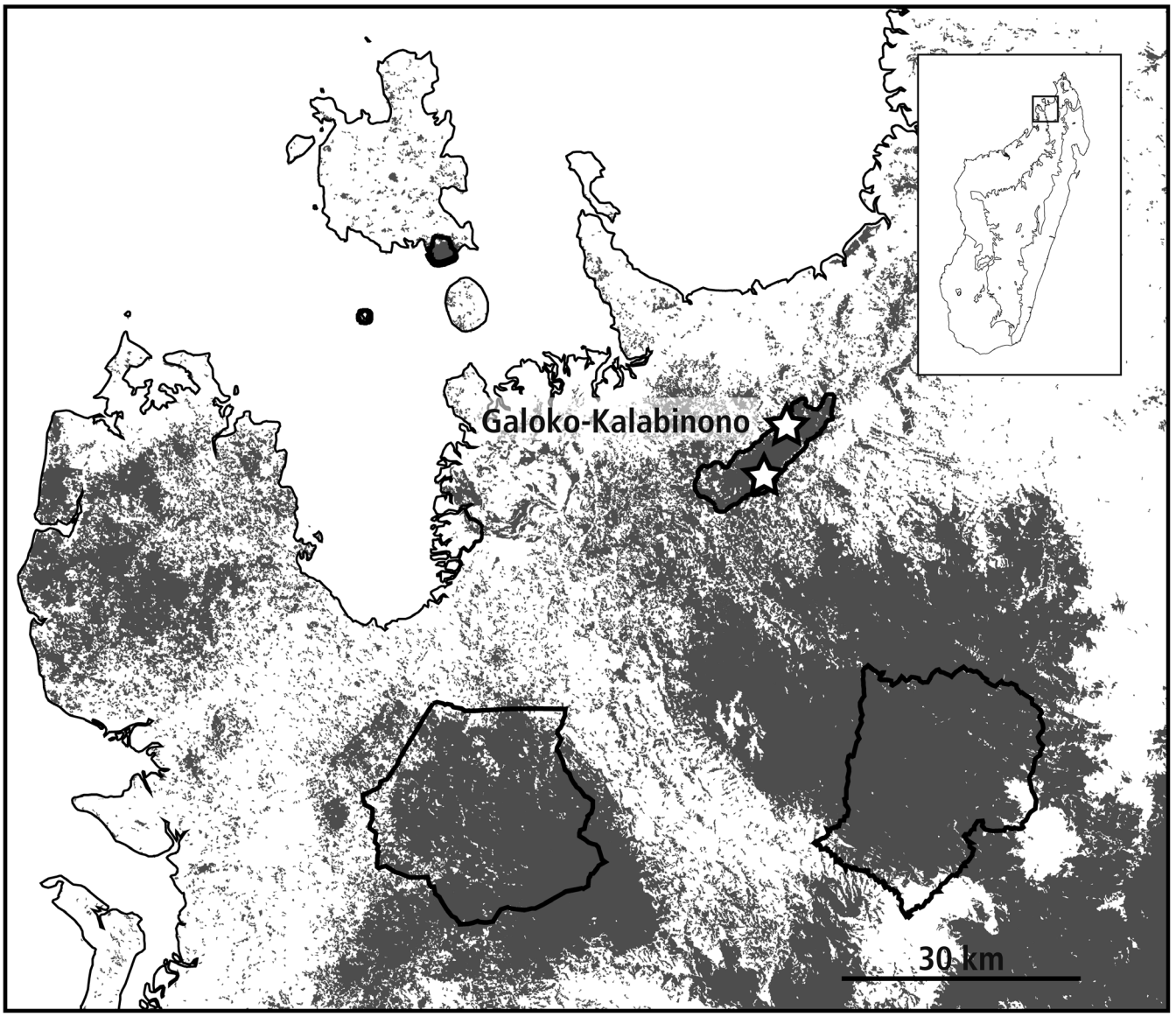

Fig. 2. – Distribution map of *Rinorea callmanderi* Wahlert (stars) in Madagascar plotted on a map of forest cover in 2000 (grey) following Harper et al. (2007). Areas outlined in black are protected areas.

domatia absent. *Inflorescence* a terminal few-flowered cyme to 2 cm long; peduncle 4-5 mm long, glabrous; pedicels 0.9-1.6 mm long, glabrous; pedicel bractlets persistent, triangular to subulate, 0.7-1 × 0.5-0.8 mm, glabrous, keeled, margin ciliate, apex acute, mucronate. *Flowers* 3.5-3.9 mm long. *Sepals* unequal, ovate-deltoid, 0.9-1.8 × 1-1.2 mm, keeled, glabrous, margin ciliate, apex acute to rounded, usually mucronate. *Petals* subequal, lanceolate, 3-3.3 × 1.1-1.3 mm, outer surface glabrous, inner surface sparsely pubescent near the middle, margin entire to ciliolate, apex subacute to acute, erect. *Stamens* 2.7-2.8 mm long; staminal tube 0.4-0.5 mm tall, outer and inner surfaces glabrous; anthers subsessile, filaments c. 0.1 mm long, anthers c. 0.7 × 0.5 mm; anther ventral connective scales linear, 0.4-0.5 × 0.1-0.15 mm, apex bifid; anther dorsal connective scales 1.4-1.5 × c. 1.0 mm, apical, ovate, scarious, drying white, surface glabrous, margin entire, apex acute. *Pistil* 2.7-2.8 mm long; ovary ovoid, 0.5-1 × c. 0.5 mm, glabrous; style 2-2.2 mm long, erect, fluted in cross-section, straight, glabrous. *Fruit* not seen.

Etymology. – The new species is named in honor of Martin W. Callmander, who collected the type material while he was coordinating the "Northern Highlands project" in Madagascar (see Callmander et al., 2009). Martin has collected

extensively throughout Madagascar, among other areas, and his excellent field collections have helped to advance the knowledge of the Malagasy flora, as well as the taxonomy and diversity of other taxa, especially the *Pandanaceae.*

Distribution and ecology. – The species is known only from the Galoko and Kalabinono massifs in Antsiranana Province in Madagascar (Fig. 2), in lowland evergreen tropical forests at an altitude of 200-800 m in the Sambirano Domain (sensu Humbert, 1955).

Phenology. – Based on herbarium specimen label data, the species flowers in November; fruiting specimens have not been collected.

Conservation status. – *Rinorea callmanderi* is known from only two localities sensu IUCN (2012), which are 7.5 km apart. The lowland tropical evergreen forests of the Galoko and Kalabinono massifs are now protected but are still threatened by human activities; particularly slash and burn agricultural practices. With only two threatened locations and a restricted range distribution, *R. callmanderi* is assigned a preliminary conservation status of "Endangered" [EN B1ab(iii)+ B2ab(iii)].

Notes. – *Rinorea callmanderi* is morphologically most similar to *R. mutica*, but is easily differentiated by its longer, lanceolate leaves to 13 cm long (compared to broadly oval-elliptic leaves to 9 cm in *R. mutica*), the sparse pubescence near the middle of the inner surface of the petal (vs. a tuft of hairs at the base of the inner surface of the petal), and by the anthers which bear ventral and dorsal connective scales, both of which are absent in *R. mutica*—a unique character state for the subsection. Based on herbarium specimen label data, the distributions of *R. callmanderi* and *R. mutica* appear to be non-overlapping. *Rinorea callmanderi* is known only from the Galoko and Kalabinono massifs at elevations of 200-800 m, whereas *R. mutica* is almost entirely confined to Nosy Be island at elevations of 20-300 m. A single collection of *R. mutica* is recorded from the "montagnes de Sambirano" *(Perrier de la Bâthie 5045),* at an elevation of 600 m, but the species has not been collected from the Galoko or Kalabinono massifs (Wahlert, 2010). Both *R. callmanderi* (as "*Rinorea* sp. nov. 1") and *R. mutica* were sampled in the phylogenies of Wahlert & Ballard (2012) and van Velzen et al. (2015). The results from both studies recovered the two species in a highly supported Verticillatae clade, but no relationships among species were resolved within the clade. Based on the opposite-leaved phyllotaxy and similar floral structure shared by other species in the subsection, as well as the results from molecular phylogenies, *R. callmanderi* is placed in *R.* subsect. *Verticillatae*. The description of *R. callmanderi* now brings to 19 the number of species belonging to the subsection, however, further study is needed for a comprehensive understanding of the species diversity within the group.

Paratypus. – **Madagascar. Prov. Antsiranana:** Ambilobe, Beramanja, Anketrabe, Belinta, forêt de Galoka, 13°35'23"S 48°42'43"E, 210 m, 6.X.2013, fl. bud, *Razakamalala et al. 7669* (G, MO, P, TAN).

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